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Women's vulnerabilities and resilience strategies regarding gendered impacts of climate change: A study on the south coastal region of Bangladesh

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ABSTRACT

Climate change constitutes one of the most pressing global challenges, with Bangladesh identified as among the most disaster-prone countries due to recurrent cyclones, salinity intrusion, riverbank erosion, and storms. A growing body of literature demonstrates that the consequences of climate change are gender-differentiated, with women disproportionately vulnerable because of entrenched socio-cultural and economic constraints that restrict access to resources, education, healthcare, and mobility (Shamsuddoha et al., 2024). This study investigates the gendered dimensions of climate-induced vulnerability and displacement in coastal Bangladesh, focusing on the lived experiences and adaptive practices of women. Employing a qualitative approach, the research draws on both primary and secondary sources, including case studies generated through snowball sampling and a review of scholarly publications, reports, and media materials. The analysis highlights how climate change exacerbates not only material insecurities but also psychosocial stressors, undermining women's coping capacities. Despite these challenges, the findings reveal that women employ a range of resilience strategies, including social networking, community participation, and the mobilization of indigenous knowledge. By situating women's adaptive practices within broader socio-economic and cultural contexts, this study contributes to understanding the intersection of gender, climate vulnerability, and displacement in disaster-prone settings.

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1. INTRODUCTION

The world today faces a wide range of challenges associated with climate change, including rising temperatures, altered rainfall patterns, droughts, floods, cyclones, disease outbreaks, food insecurity, and ecosystem disruptions. While climate shifts have generally unfolded gradually over Earth's history, research indicates that abrupt changes can occur when ecological thresholds are crossed, leading to sudden fluctuations in temperature, precipitation, and related factors (Pareek & Trivedi, 2011). Climate change affects communities across the globe regardless of caste, class, gender, ethnicity, or religion, yet its impacts are highly

differentiated. Bangladesh is widely recognized by climatologists and disaster experts as one of the most vulnerable countries in the world (Garai, 2017).

Although both men and women experience the adverse consequences of climate change, their vulnerabilities differ. Women in developing countries often face disproportionate impacts due to intersecting social, economic, and environmental marginalities (Alston, 2014; Rao et al., 2019). Gender relations shape roles, responsibilities, and access to resources, which in turn influence exposure to risks and adaptive capacity (Hai & Smyth, 2012). Restricted access to land, credit, education, and healthcare further exacerbates women's vulnerability (Bouchama et al., 2018). Climate change thus compounds existing inequalities and deepens the marginalization of women (Onwutuebe, 2019).

Empirical studies in Bangladesh highlight this gendered vulnerability. For example, Shamsuddoha et al. (2024), in their study on the southwest coast, found that women face heightened risks from cyclones, salinity intrusion, and riverbank erosion. Their analysis, based on survey and focus group data, showed that these hazards disrupt livelihoods, constrain access to education and healthcare, and contribute to reproductive health issues, particularly among fisherwomen. The study underscores the human rights implications of climate change for women and calls for inclusive social safety nets and alternative livelihood options.

Women's vulnerability is further heightened after extreme weather events, as they often prioritize family needs over their own, leading to food insecurity, health risks, and loss of livelihoods (Ahmed et al., 2019). Despite substantial research on Bangladesh's climate vulnerability, relatively little attention has been paid to women's lived experiences and coping strategies in coastal regions. Addressing this gap, the present study explores the specific challenges faced by coastal women and the resilience strategies they employ in the face of climate-induced hazards.

The findings of this research are intended to inform policymakers and development practitioners in formulating gender-responsive adaptation strategies that strengthen women's resilience and, by extension, enhance community-wide adaptive capacity. Recognizing and incorporating women's knowledge, household resource management, and community roles into adaptation planning is essential for effective and inclusive climate responses (Garai, 2017). Accordingly, this study examines the gendered impacts of climate change on women in Bangladesh's southern coastal region and identifies the strategies through which they negotiate and adapt to these challenges.

2. LITERATURE REVIEW

Global warming has altered climate patterns worldwide, leading to glacial melting, sea-level rise, and increased frequency of natural hazards (Garai, 2017). Climate change is considered one of the most significant challenges in human history, as its far-reaching consequences heighten the risks of disease outbreaks, cyclones, floods, and heat waves. Women, in particular, face difficulties in adapting when climate change disrupts income generation, food production, and access to water. Gendered divisions of labor exacerbate this vulnerability: while men are typically responsible for income and cultivating cash crops, women often manage household resources essential for nutrition and health (Ajani et al., 2013).

Bangladesh exemplifies the inequities associated with climate change. Despite contributing only 0.4% of global greenhouse gas emissions in 2018, the country has suffered extensive losses of life, resources, and infrastructure (World Bank, 2022). Women's vulnerability is compounded by entrenched gender roles, limited decision-making power, and structural inequalities, which reduce their ability to cope effectively with climate-induced challenges (Juran & Trivedi, 2015).

During climate-related disasters, women frequently experience higher mortality rates than men. For example, during the 1991 cyclone and floods in Bangladesh, women's death rates were nearly five times higher than men's (Sharmin & Islam, 2013). Similarly, Cyclone Sidr in 2007 and the tropical storm of 2013 resulted in disproportionately high female casualties (Alam & Rahman, 2014). These disparities are shaped by societal norms, responsibilities for children and household assets, lack of access to transportation and communication, and limited life-saving skills such as swimming or climbing (Hossain et al., 1992). Physical constraints, including pregnancy, disability, and past negative experiences with shelters, further restrict women's ability to seek safety.

Beyond physical vulnerabilities, women are also exposed to heightened risks of sexual and domestic violence during and after climate events (Rahman, 2013). For instance, in coastal Bangladesh, water salinity often forces women and adolescent girls to travel long distances to collect safe drinking water, increasing the risk of sexual

harassment (Imran et al., 2022). Families may also resort to child marriage as a coping mechanism, further entrenching gender inequalities (Asadullah et al., 2021).

The psychological and health impacts of climate change on women are profound. Pregnant and breastfeeding mothers in shelters frequently encounter poor sanitation, unsafe drinking water, and inadequate medical care, which intensify their vulnerability (Nur et al., 2021). Malnutrition, waterborne diseases, and limited reproductive healthcare exacerbate the risks (Rahman, 2013). Exposure to salinity during pregnancy has been linked to hypertension, pre-eclampsia, and elevated neonatal mortality (Shammi et al., 2019). Climate change thereby affects women's physical and mental health simultaneously (Goodman, 2016).

Research also highlights the broader role of climate change in deepening pre-existing inequalities. Schuster et al. (2024) argue that both existing and emerging disparities—linked to socioeconomic status, ethnicity, and caste—intensify during displacement, with women and girls bearing particularly severe consequences.

Several studies have also documented indigenous and community-based coping mechanisms. Hasan (2008), studying coastal Kuakata, found that local communities employ traditional forecasting and disaster management strategies that often complement or substitute formal state measures. Similarly, Mallick et al. (2009) emphasized the importance of inclusive approaches that integrate household, community, and institutional resilience. Women in coastal regions often rely on traditional knowledge to prepare for and respond to hazards. They strengthen their homes with locally available materials, raise household foundations, safeguard livestock, and store dry foods and emergency supplies (Islam, 2010).

Other adaptation strategies include reinforcing homes with durable materials such as bamboo or goran wood, forming community savings groups, and seeking small loans for disaster preparedness (Sultana & Mallick, 2015). However, common coping mechanisms—such as eating less, taking loans, or accepting low-wage employment—frequently result in malnutrition, economic hardship, and domestic tension (Yasmin & Ahmed, 2013).

Taken together, the literature demonstrates that women in coastal Bangladesh are disproportionately affected by climate-induced hazards due to gendered vulnerabilities, while also playing a crucial role in household- and community-level adaptation. Yet, much of the scholarship remains focused on women's vulnerabilities rather than their agency and resilience. This study therefore contributes by examining not only the gendered impacts of climate change but also the adaptive strategies coastal women employ to sustain their livelihoods and communities.

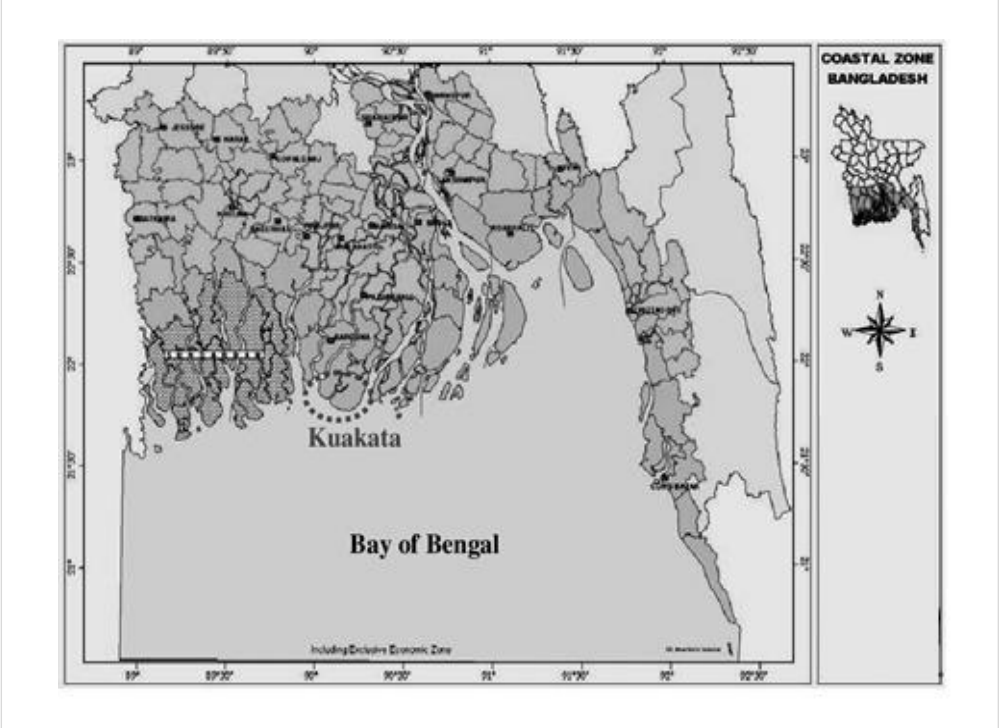

Figure 1. Study area Map (Kuakata)

Note: The study area photo, presented in Figure 1, has been adapted from Islam et al. (2009).

3. METHOD

This study employed a qualitative research design, which is particularly suited to investigating questions that focus on the *why* and *how* of human experiences, emphasizing social interactions and processes (Agee, 2009). Qualitative methods allow researchers to explore complex issues that are not easily quantified and provide a deeper understanding of women's experiences of vulnerability and resilience in climate-affected coastal areas. As prior research has already established the relevance of this field, qualitative approaches were deemed most appropriate for addressing the study objectives.

To capture women's lived experiences, the research adopted Creswell's (2007) phenomenological approach. Phenomenology seeks to explore and describe the essence of shared experiences among individuals, with the goal of identifying common patterns of meaning. This approach was considered suitable for examining women's dual roles within socially constructed gender norms, and for analyzing how these roles shape their encounters with climate-induced hazards. As van Manen (1990) emphasizes, phenomenological inquiry is valuable for grasping the nature of lived human experiences and revealing their underlying structures.

The study was conducted in Kuakata (Latachapli Union), a coastal area in the Patuakhali district of southern Bangladesh, locally known as the '*daughter of the sea*'. Kuakata is highly vulnerable to cyclones and tidal surges, which significantly disrupt local livelihoods. Due to the researcher's residence outside Bangladesh at the time of study, data collection relied on the support of a university student based in the area. Five women respondents (aged up to 30 years) were purposively selected for in-depth case studies using snowball sampling, whereby one respondent facilitated contact with others.

In addition to primary data, secondary sources were extensively consulted. These included published research articles, reports, and other scholarly literature, which were analyzed through content analysis to supplement and contextualize the primary findings.

4. FINDINGS AND DISCUSSION

4.1. Socio-Demographic Characteristics and Gendered Vulnerability

The respondents' socio-demographic characteristics—age, education, marital status, and economic status—provide a crucial entry point for understanding how climate change interacts with pre-existing gender inequalities in coastal Bangladesh. The five women, aged between 31 and 42, represent a critical age group where women are simultaneously responsible for household reproduction, childcare, and economic contribution. This life stage makes them highly sensitive to shocks that disrupt household stability, such as climate-induced disasters.

Table 1. Respondents Profile

Respondents	Age	Education	Marital Status	Earning (monthly)
Respondent 1	31	Primary	Married	15,000 BDT
Respondent 2	34	Under SSC	Married	17,000 BDT
Respondent 3	42	Primary	Divorced	20000 BDT
Respondent 4	39	Illiterate	Unmarried	15000 BDT
Respondent 5	35	Primary	Married	20,000 BDT

4.1.1. Education and Interrupted Aspirations

Education levels among the respondents are notably low: three completed only primary schooling, one did not complete SSC, and one is illiterate. Such educational marginalization reduces women's opportunities to secure alternative livelihoods beyond subsistence farming, fisheries, or informal work, leaving them disproportionately exposed to climate risks. Respondent 1's testimony highlights the link between poverty, education, and child marriage: she was forced into marriage at a young age because her parents could not afford the costs of her schooling. Her statement, "*I wanted a normal life like others, wanted to study, but dream is not fulfilled, now I carry a family life only*," underscores how structural economic constraints, intensified by climate change, deny women the chance to pursue education and independence.

This aligns with broader findings that economic strains following disasters, such as loss of crops, livestock, or fishing resources, push families to prioritize short-term survival strategies over long-term investments like

education (Girls Not Brides, 2020). Consequently, girls' education becomes one of the first sacrifices, entrenching intergenerational cycles of gender inequality and poverty.

4.1.2. Marital Status and Gendered Dependence

The marital status of respondents—three married, one divorced, and one unmarried—illustrates how marriage functions both as a social norm and a coping mechanism in disaster-affected regions. Families under economic pressure often resort to early marriage to reduce household costs or secure daughters' perceived protection. Yet, marriage does not necessarily shield women from vulnerability. Married respondents reported increased reproductive and care responsibilities, which become especially burdensome during disasters.

For divorced or unmarried women, vulnerabilities manifest differently. Respondent 3, a divorced woman, emphasized the struggle for "*enough pure drinking water during and after the hazards*," reflecting her dependence on unstable community resources without spousal or extended family support. Similarly, Respondent 4, an illiterate and unmarried woman, highlighted the pressure from her parents when she failed to collect food during disasters. This demonstrates how single women in patriarchal settings often face blame and social exclusion despite having the least capacity to mitigate environmental shocks.

4.1.3. Economic Status and Limited Resilience

The respondents' monthly incomes ranged from 15,000 to 20,000 BDT, levels that fall within the low-income category in Bangladesh's rural context. While these figures may indicate modest earnings, they are insufficient for recovery from repeated climate shocks. For example, rebuilding homes, replanting crops, or seeking medical care requires resources far beyond these income levels. As Respondent 2's tragic story during Cyclone Aila illustrates, even families with some economic activities are unable to secure timely healthcare access when infrastructure collapses. She lost her unborn twins due to being stranded without transport or emergency medical facilities—an outcome shaped by both poverty and systemic service gaps in disaster-prone regions.

Respondent 5's case also exemplifies how economic participation does not equate to resilience. Despite contributing financially as a fisherwoman (earning 20,000 BDT/month), she suffered two miscarriages due to exposure to saline water. Her situation reveals that women's labor, particularly in resource-dependent livelihoods, exposes them to climate-related health hazards, undermining their well-being and household stability.

4.1.4. Intersection of Gender Roles and Climate Change

The respondents' testimonies also highlight the erosion of traditional gender roles under climate stress. Women in coastal areas typically engage in resource collection—such as firewood, water, and forest products—alongside small-scale agricultural activities. However, salinity intrusion, soil degradation, and loss of biodiversity have reduced their ability to perform these roles. Respondent 4 explained: "*I cannot collect or harvest food during and after the disaster, that's suffers my family and for that reason, my parents blame me also*". This illustrates how women are unfairly held accountable for resource scarcity, even when environmental degradation is beyond their control. Such gendered blame adds psychological stress, intensifying their vulnerability.

4.1.5. Physical and Psychological Burdens

Climate change's impacts extend beyond economic and physical domains to affect women's psychological well-being. Respondents expressed feelings of anxiety, stress, and helplessness, stemming from disrupted livelihoods, loss of children, and family pressures. Respondent 5 linked her miscarriages directly to environmental conditions, while Respondent 1 lamented the unfulfilled dream of education and independence. These narratives reveal the deep emotional scars left by climate disasters, reflecting findings that women in climate-vulnerable regions face disproportionate mental health burdens (Alston, 2015).

4.1.6. Synthesis: Multi-layered Vulnerability

Taken together, respondents' narratives and socio-demographic profiles demonstrate the multi-layered nature of gendered vulnerability. Table 1, when read alongside respondents' narratives, demonstrates how climate change interacts with pre-existing social hierarchies to produce multi-layered vulnerabilities. Limited education curtails opportunities, marital status determines dependency or exclusion, and low income restricts recovery options. At the same time, gendered roles expose women to health risks, psychological strain, and social blame. The intersectionality of these factors confirms that climate change is not a gender-neutral

phenomenon; it magnifies existing inequalities and disproportionately undermines women's rights, health, and dignity in coastal Bangladesh.

4.2. Adaptive Strategies and Resilience in Coastal Bangladesh

Despite the considerable threats posed by cyclones and other climate-induced hazards, coastal communities in Bangladesh have developed diverse adaptive strategies, combining indigenous knowledge, social organization, and institutional support to enhance resilience. These strategies demonstrate a dynamic interplay between traditional practices, community cooperation, and external interventions, enabling residents to mitigate the adverse effects of natural disasters.

4.2.1. Indigenous Knowledge and Early Warning Practices

Traditional ecological knowledge forms the backbone of disaster preparedness in many coastal communities. Elderly residents, often recognized as local experts, observe subtle environmental cues to predict cyclones and tidal surges. For example, persistent easterly winds, prolonged drizzle, sudden changes in wind patterns, and dark cloud formations in specific directions are interpreted as signals of impending storms. Such knowledge is not only a cultural inheritance but also a practical tool for risk reduction. Households often act on these cues by relocating livestock to elevated areas, storing essential food and valuables, and constructing temporary shelters before the arrival of a cyclone.

In addition to individual household measures, community-based early warning systems complement this indigenous knowledge. Village committees, sometimes comprising elders, volunteers, and local leaders, disseminate alerts using loudspeakers, visual signals such as black flags, and door-to-door announcements. These local warning mechanisms are particularly critical in areas with limited access to meteorological updates or modern communication networks (Choudhury et al., 2021). By combining traditional observations with community mobilization, these systems improve preparedness and reduce potential loss of life and property.

4.2.2. Structural and Environmental Coping Measures

Physical adaptations to housing and local environments constitute another central aspect of resilience. Many coastal households elevate their homes on plinths to avoid floodwater damage, which is particularly important during high tides and storm surges. Construction materials are carefully chosen for their flexibility rather than durability; bamboo, Goran leaves, and straw are widely used to construct walls and roofs. Although these materials may fail under severe cyclonic forces, their breakable nature reduces the risk of serious injuries to inhabitants (Shahid, 2011).

Residents also employ roof anchoring techniques, tying straw or thatch to large trees or ground stakes to prevent displacement during high winds. Strategic planting of large trees around houses serves as an effective windbreak, mitigating structural damage. Such measures illustrate how environmental modifications—combined with construction adaptations—can reduce the physical vulnerability of households in hazard-prone areas. In addition, the use of temporary shelters constructed from available local materials demonstrates resourcefulness and a high degree of situational adaptability among community members (Paul et al., 2016).

4.2.3. Social and Household Coping Mechanisms

In addition to structural adaptations, social and household strategies are crucial for reducing vulnerability. Women play a central role in these coping mechanisms, ensuring the safety of children, the elderly, and household possessions during disasters. They also contribute to the relocation of livestock, securing of food and essential documents, and the coordination of temporary shelters. Young community members often assist the elderly and other vulnerable individuals by providing food, water, and basic medical care during and after cyclones. These practices highlight the importance of social networks and collective responsibility as integral components of community resilience.

Religious and spiritual practices further contribute to coping capacity. Muslims frequently engage in prayers during cyclones, while Hindu residents recite mantras and perform rituals. Although these activities may not directly prevent physical damage, they provide emotional support, reduce anxiety, and reinforce social cohesion, thereby strengthening the community's psychological resilience (Paul et al., 2016). Such culturally embedded practices illustrate the role of intangible social and psychological resources in disaster preparedness and recovery.

4.2.4. Livelihood and Economic Resilience

Cyclones such as Sidr (2007) and Aila (2009) have significantly disrupted livelihoods in coastal Bangladesh, damaging agricultural land, salinizing soil, reducing fishery yields, and depleting forest resources. These events

exacerbate poverty and undermine economic stability, forcing households to adopt diverse livelihood strategies to sustain themselves (Reynaud & Lanzanova, 2017).

Community members often diversify income sources by engaging in shrimp farming, small-scale poultry or livestock rearing, and the collection of wild foods such as shellfish, fruits, and firewood. Women's labor is particularly critical in these strategies, as they collect wild foods, manage household-level production activities, and participate in shrimp farming. Although women often receive lower wages than men, their contributions are essential for household survival and overall community resilience.

Households also rely on informal social networks and institutional support to cope with economic shocks. Family members, neighbors, and local community groups often provide financial and material assistance during crises. Non-governmental organizations (NGOs) provide emergency loans, temporary employment opportunities, and access to food and water, allowing households to survive and gradually rebuild livelihoods. These mechanisms reduce the economic vulnerability of households, particularly those with limited financial capital or low land ownership.

4.2.5. Institutional and Community-Based Interventions

Local government agencies and non-governmental organizations (NGOs) play a complementary role in strengthening resilience. Initiatives include alternative employment programs, infrastructure improvements, disaster preparedness training, and emergency food distribution. NGOs such as Karmoshostan integrate indigenous knowledge into training programs, teaching residents how to combine traditional coping strategies with modern disaster management practices.

Afforestation projects are also undertaken to reduce environmental vulnerability. Tree planting not only prevents soil erosion and mitigates salinity intrusion but also provides supplementary sources of income through fruits, firewood, and timber (Shahid, 2011). These interventions highlight the importance of combining institutional support, environmental restoration, and community participation to build long-term resilience.

4.2.6. Gender-Sensitive Resilience Strategies

A critical feature of coastal adaptation is the gendered dimension of resilience. Women, who often bear the brunt of disaster impacts due to social and cultural norms, actively contribute to preparedness and recovery. Their involvement ranges from protecting family members to managing post-disaster livelihood activities and participating in communal relief distribution. Policies and programs that enhance women's access to education, vocational training, and income-generating activities significantly increase community resilience. For instance, women trained in alternative livelihoods such as aquaculture, poultry, and small-scale handicrafts can support household economies even during environmental disruptions (Alam & Rahman, 2014).

5. CONCLUSION

The study highlights the profound impacts of climate change on women in the South Coastal region of Bangladesh, where cyclones, tidal surges, floods, and salinity intrusion are frequent. Women in these areas face unique vulnerabilities due to socio-economic inequalities, limited education, restricted mobility, and gendered social norms. These factors exacerbate the physical, economic, and psychological impacts of climate-induced hazards. Women experience increased workloads, disrupted livelihoods, health risks, and social insecurity, while displacement and loss of resources contribute to heightened anxiety, stress, and feelings of helplessness. Early marriage and interrupted education are common coping strategies among affected families, further reinforcing gendered disadvantages and limiting long-term opportunities.

Despite these challenges, women demonstrate remarkable resilience. They actively participate in household- and community-level adaptation strategies, including observing environmental cues to anticipate disasters, engaging in community-based early warning systems, securing homes and livestock, and supporting vulnerable family members. Women also contribute to livelihood diversification through activities such as shrimp farming, small-scale agriculture, livestock rearing, and the collection of wild foods. Their labor, though often undercompensated, is essential for sustaining households and local economies. Social networks and community support systems further strengthen resilience, allowing women to access food, water, financial assistance, and healthcare during crises. Spiritual and religious practices also provide psychological support, reinforcing mental well-being and social cohesion.

However, structural challenges continue to limit women's adaptive capacity. Restricted access to education, financial resources, healthcare, and decision-making platforms constrains their ability to prepare for and recover from disasters. Pregnant women and mothers are particularly vulnerable due to inadequate maternal

healthcare services and disrupted infrastructure during climate events. Addressing these challenges requires targeted, gender-sensitive interventions that empower women and enhance community resilience.

Key strategies include improving access to education and vocational training focused on climate-resilient livelihoods, providing financial inclusion through microfinance and savings schemes, and establishing accessible maternal healthcare services, including mobile clinics. Promoting women's participation in local governance and disaster management ensures that adaptation policies reflect their needs and perspectives. Investment in climate-resilient infrastructure—such as elevated homes, flood-resistant shelters, and safe water and sanitation facilities—further mitigates risks. Integrating gender perspectives into national climate adaptation and disaster risk reduction policies is essential for long-term sustainability, equitable development, and enhanced resilience.

In conclusion, women in coastal Bangladesh face multidimensional vulnerabilities amplified by climate change, but they also exhibit adaptive capacities that sustain households and communities. Supporting women through education, financial resources, healthcare, governance participation, and climate-resilient infrastructure is crucial for fostering gender equity, sustainable development, and overall community resilience. Recognizing women as active agents of change, rather than merely vulnerable populations, is vital for effective climate adaptation in the South Coastal region and in similarly vulnerable contexts globally (Alam & Rahman, 2014; Alston, 2015).

This study demonstrates that climate change in the South Coastal region of Bangladesh intensifies women's vulnerabilities not because hazards themselves are gendered, but because they interact with structural inequalities in education, healthcare, income, and social norms. The loss of unborn children during Cyclone Aila due to inaccessible medical facilities, and miscarriages linked to salinity exposure, illustrate how climate shocks intersect with inadequate infrastructure and weak service provision, confirming wider evidence on reproductive health risks in coastal Bangladesh (Shammi et al., 2019; Nur et al., 2021). Similarly, interrupted schooling and early marriage, as described by respondents, reflect how economic pressures in disaster-prone areas curtail women's opportunities and entrench cycles of disadvantage. Yet the findings also reveal women's active resilience: they mobilize indigenous knowledge, secure food and livestock, diversify livelihoods, and sustain households, aligning with broader research that identifies women as central to adaptation (Alam & Rahman, 2014). These results underscore a critical policy lesson: climate vulnerability is socially constructed and therefore reducible through structural reform. Gender-sensitive interventions in education, healthcare, financial inclusion, and governance are not only questions of justice but strategic imperatives, as investing in women multiplies resilience outcomes at household and community levels. Recognizing women as active agents of adaptation, rather than passive victims, is thus essential for equitable and sustainable climate policy in Bangladesh and other vulnerable contexts.

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Notes

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